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# (54) COLOR IMAGE PICKUP ELEMENT AND IMAGE PICKUP DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To enable image pickup having a good color reproducibility as in the case of using RGB filters and having a high sensitivity as in the case of using CMY filters.

SOLUTION: The element is arranged so that color filters are disposed at each pixel for pickup of a color image to obtain signals corresponding to 3 primary colors R, G and B. In this case, the RGB filters arranged in a Bayer array as well as CMY filters arranged in a Bayer array are arranged in a checked lattice form to select outputs of the RGB and CMY filters according to the brightness of an object to be photographed.

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## CLAIMS

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[Claim(s)]
[Claim 1]colour coding was carried out -- a photoelectric conversion face -- the spectral sensitivity characteristic of each pixel which is an image sensor with an imaging surface and constitutes said imaging surface -- additive color mixture -- the three primary colors -- RGB and subtractive color mixture -- the three primary colors -- a color imaging device being a thing including a total of six colors of CMY.
[Claim 2]The color imaging device according to claim 1 characterized by a thing between which arrangement of said colour coding consists of a Bayer array which comprises RGB, and a Bayer array which comprises CMY, and each Bayer array does not share neighborhood of each other, and which has been arranged in checkers.
[Claim 3]An imaging device comprising:
The color imaging device according to claim 1.
An image signal generating means which generates a predetermined picture signal based on a RGB system output or a CMY system output of this image sensor.
A photographic subject luminosity judging means which judges a luminosity of a

photographic subject.
A selection-control means to choose any of an output of two lines of an image sensor used based on an output of this photographic subject luminosity judging means by a picture signal generation process in said image signal generating means they are.

[Claim 4]An imaging device comprising:
The color imaging device according to claim 1.
An image signal generating means which generates a predetermined picture signal based on an output of this image sensor.
An automatic controlling means which performs predetermined automatic control based on a RGB system output or a CMY system output of said image sensor.
A selection-control means to choose any of an output of two lines of an image sensor output used by automatic control processing in said automatic controlling means based on an output of a photographic subject luminosity judging means which judges a luminosity of a photographic subject, and this photographic subject luminosity judging means they are.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]

[Field of the Invention]This invention relates to the imaging device using the color imaging device and this which aimed at especially improvement of colored filter arrangement with respect to the image sensor used for an electronic camera (digital still camera), a video camera, etc.

[0002]

[Description of the Prior Art]In recent years, the electronic camera which memorizes the image data obtained by picturizing an object image by a CCD image sensor etc. to flash memories, such as CompactFlash (CF) and SmartMedia (SSFDC), is put in practical use. Since this electronic camera is small and lightweight and rewriting of image data is still more possible, it is expected that it will spread increasingly from now on.

[0003]By the way, in order to picturize a color picture by a CCD image sensor, it is necessary to arrange a colored filter to each pixel of an image sensor, and to acquire the signal corresponding to the three primary colors of RGB. There are two kinds of colored filters of a CCD color imaging device, the RGB system filter which is a primary color system, and the CMY system filter which is complementary color systems.

[0004]

[Problem(s) to be Solved by the Invention]However, when a RGB system filter and a CMY system filter were used, there were the following problems. That is, although it is good, since sensitivity is low, the image pick-up of a dark scene is difficult for color reproduction nature, when a RGB system filter is used. When a CMY system filter is used, the image pick-up of the scene where sensitivity is high and dark is also possible, but compared with a RGB system filter, color reproduction nature is inferior. That is, even if it used which filter, both color reproduction nature and sensitivity were not able to be satisfied.

[0005]There is a place which accomplished this invention in consideration of the above-mentioned situation, and is made into the purpose in providing the imaging device using the color imaging device and this which can realize the characteristic that sensitivity is high, like the case where color reproduction nature was good and uses a CMY system filter like the case where a RGB system filter is used.

[0006]

[Means for Solving the Problem](Elements of the Invention) In order to solve an aforementioned problem, this invention has adopted the following composition.

[0007]That is, this invention is a color imaging device with a photoelectric conversion face slack imaging surface by which colour coding was carried out, and the spectral sensitivity characteristic of each pixel which constitutes said imaging surface is

characterized by being a thing including a total of six colors of three-primary-colors slack RGB of additive color mixture, and the three-primary-colors slack CMY of subtractive color mixture.

[0008]This invention is characterized by that an imaging device which used a color imaging device of the above-mentioned composition comprises:

An image signal generating means which generates a predetermined picture signal based on a RGB system output or a CMY system output of an image sensor.

A photographic subject luminosity judging means which judges a luminosity of a photographic subject.

A selection-control means to choose any of an output of two lines of an image sensor used based on an output of this photographic subject luminosity judging means by a picture signal generation process in said image signal generating means they are.

[0009]This invention is characterized by that an imaging device which used a color imaging device of the above-mentioned composition comprises:

An image signal generating means which generates a predetermined picture signal based on an output of an image sensor.

An automatic controlling means which performs predetermined automatic control based on a RGB system output or a CMY system output of said image sensor.

A photographic subject luminosity judging means which judges a luminosity of a photographic subject.

A selection-control means to choose any of an output of two lines of an image sensor output used by automatic control processing in said automatic controlling means based on an output of this photographic subject luminosity judging means they are.

[0010]Here, the following are raised as a desirable embodiment of this invention.

(1) A thing between which arrangement of colour coding consists of a Bayer array which comprises RGB, and a Bayer array which comprises CMY, and each Bayer array does not share neighborhood of each other and which has been arranged in checkers.

(2) An automatic controlling means should adjust exposure and a focus based on a RGB system output or a CMY system output.

(3) Generate one pixel signal from a mass of 4x4, shift two picture element pitches of masses at a time, and acquire a two-dimensional pixel signal.

[0011](OPERATION) According to this invention, an output of a RGB system and an output of a CMY system can be obtained with one image sensor by giving a total of six colors of three-primary-colors slack RGB of additive color mixture, and the

three-primary-colors slack CMY of subtractive color mixture to the spectral sensitivity characteristic of each pixel which constitutes an imaging surface. What is necessary is just to arrange both a filter of a RGB system, and a filter of a CMY system, in order to give the above-mentioned spectral sensitivity characteristic.

[0012]And the optimal image pick-up according to a photographic subject is attained by choosing which filter according to a luminosity of a photographic subject, etc. That is, when a photographic subject is bright enough, a good picture of color reproduction nature is acquired by choosing a RGB system filter. When a photographic subject is dark, even if it is when dark, little image pick-up of a noise is attained by choosing a CMY system filter.

[0013]In this invention, in order to use not all pixels for generating a chrominance signal, resolution falls (usually set to one half). However, when a pixel number of an image sensor fully increases by future high pixel-ization, a fall of resolution by alternative use of a pixel can be disregarded now, and an effect of above-mentioned this invention becomes more effective.

[0014]

[Embodiment of the Invention]Hereafter, the embodiment of a graphic display of the details of this invention explains.

[0015]Drawing 1 is a block diagram showing the circuitry of the imaging device concerning a 1st embodiment of this invention.

[0016]101 in a figure a lens system and 102 lens driving and 103 An exposure control mechanism, The CCD color imaging device in which 104 built filter systems, such as LPF, and 105 built the colored filter, The Puri process part in which 106 contains a CCD driver in and 107 contains an A/D converter etc., A digital process part for 108 to perform chrominance-signal generation processing, a matrix conversion process, and various kinds of other digital processings, 109 -- a card interface and 110 -- memory cards, such as CF, and 111 -- an operation switch system and 114 show an operation display system, 115 shows a lens driver, and, as for a system controller (CPU) and 113, an LCD image display system and 112 show the exposure control driver 116.

[0017]Although the above-mentioned basic constitution is the same as that of a conventionally common device, the point that this embodiment differs from this is in the composition of the CCD color imaging device 105, and also processing by the digital process part 108 accompanying this. The image sensor of this embodiment has an imaging surface which consists of arrangement of an optoelectric transducer with six color characteristics which are the six spectral sensitivity characteristics of

three-primary-colors RGB of additive color mixture, and CMY of subtractive color mixture.

[0018]The arrangement of the colored filter in a color imaging device is a Bayer array as shown in drawing 2. That is, an optoelectric transducer is level, and it is an orthogonal array of a vertical 2-way, the arrangement of three colors of a RGB system filter is a Bayer array by which diagonal arrangement of R, B, and G and G was carried out, respectively, and the arrangement of three colors of a CMY system filter is a Bayer array by which diagonal arrangement of C, M, and Y and Y was carried out, respectively similarly. And each Bayer array of a RGB system filter and a CMY system filter shares and twists the neighborhood of each other, and is arranged in checkers.

[0019]The chrominance-signal generation processing at the time of using the above-mentioned color imaging device is explained. The mass of 4x4 surrounded with the dashed line in drawing 2 is a primitive lattice of chrominance-signal generation, when choosing a RGB system, a pixel signal is generated by two R in a mass, two B, and four G, and when choosing a CMY system, a pixel signal is generated by two C in a mass, two M, and four Y. And the two-dimensional pixel signal has been acquired by shifting two picture element pitches of the above-mentioned masses at a time.

[0020]Drawing 3 is a figure showing the light-receiving sensitivity distribution of a CCD image sensor, and (a) is a part for the light-receiving sensitivity distribution in a RGB system filter, and light-receiving sensitivity [ in / in (b) / a CMY system filter ].

[0021]Drawing 4 is a flow chart for explaining the operation in this embodiment. First, the absolute luminance level in (1st release) and a photographic subject is measured by the start of processing (S1). In this measurement, it is also possible to measure the luminosity of the direction of a photographic subject by a sensor, and to use the output of a CCD image sensor.

[0022]Subsequently, it judges whether the measured luminosity is beyond a predetermined value (S2), and if it is beyond a predetermined value, exposure and a focus will be adjusted automatically using the output of a RGB system (S3). If smaller than a predetermined value, exposure and a focus will be adjusted automatically using the output of a CMY system (S4).

[0023]Subsequently, with 2nd release (S5), the colored filter of a RGB system and a CMY system picturizes an object image by the color imaging device by which the Bayer array was carried out, respectively, and amplifies the signal from each optoelectric transducer (each pixel) of a color imaging device. And after carrying out the A/D conversion of the amplified signal, each BEIYA data is stored and a white balance is adjusted (S6).

[0024]Subsequently, it judges whether the measured luminosity is beyond a predetermined value (S7), and if it is beyond a predetermined value, chrominance-signal generation processing will be performed using the output of a RGB system (S8), and matrix processing for RGB will be performed further (S9). About chrominance-signal generation, it is as having explained using said drawing 2, and the color signal of 1 pixel is generated from the RGB system output in the mass of 4x4, it shifts two picture element pitches of masses at a time, and a two-dimensional picture signal is generated. In matrix processing, in order to reduce a color reproduction error by well-known matrix conversion, spectral sensitivity is amended. On the other hand, if luminosity is below a predetermined value, chrominance-signal generation processing will be performed using the output of a CMY system (S10), and matrix processing for CMY will be performed further (S11).

[0025]Subsequently, after performing gamma conversion process and Y/C separation to the obtained RGB code, JPEG compression processing is performed and the compressed image data is recorded on a memory card etc. (S12).

[0026]Thus, when the luminosity of a photographic subject is beyond a predetermined value according to this embodiment (i.e., when a photographic subject is bright), the good RGB code of color reproduction nature is obtained by performing chrominance-signal generation processing using the output (RGB system output) of the optoelectric transducer which has arranged the RGB system filter. With this, conversely, when the luminosity of a photographic subject is smaller than a predetermined value (i.e., when a photographic subject is dark), although some color reproduction nature is inferior, a RGB code with few noises is obtained by performing chrominance-signal generation processing using the output (CMY system output) of the optoelectric transducer which has arranged the CMY system filter.

[0027]This invention is not limited to the embodiment mentioned above. In an embodiment, although RGB and CMY were made into the Bayer array, respectively, not only this but various kinds of arrangement is possible. For example, as shown in drawing 5, arrangement which replaced a part of G and Y from the arrangement shown in drawing 2 is also possible. The composition of an imaging device is not limited to drawing 1 at all, and can be suitably changed according to specification. In addition, in the range which does not deviate from the gist of this invention, it can change variously and can carry out.

[0028]

[Effect of the Invention]As explained in full detail above, according to this invention, the output of a RGB system and the output of a CMY system can be obtained with

one image sensor by giving a total of six colors of three-primary-colors slack RGB of additive color mixture, and the three-primary-colors slack CMY of subtractive color mixture to the spectral sensitivity characteristic of each pixel which constitutes an imaging surface. And little good image pick-up of a noise of color reproduction nature is attained by choosing which [ two ] output according to the luminosity of a photographic subject, etc.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The block diagram showing the circuitry of the imaging device concerning one embodiment of this invention.

[Drawing 2]The figure showing the arrangement of the colored filter in the color imaging device used for the embodiment.

[Drawing 3]The figure showing the spectral sensitivity characteristic of the RGB system in the color imaging device used for the embodiment, and a CMY system.

[Drawing 4]The flow chart for explaining the operation in an embodiment.

[Drawing 5]The figure showing the arrangement of the colored filter in the color imaging device concerning the modification of this invention.

[Description of Notations]

101 -- Lens system

102 -- Lens driving

103 -- Exposure control mechanism

104 -- Filter system
105 -- CCD image sensor
106 -- CCD driver
107 -- PURIPUROSESU
108 -- Digital process
109 -- Card interface
110 -- Memory card
111 -- LCD image display system
112 -- System controller
113 -- Operation switch system
114 -- Operation display system
115 -- Lens driver
116 -- Exposure control driver